

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A multi-carrier CDMA radio transmitting method replicating each information symbol, disposing ~~thus-obtained~~ the replicated information symbols along a frequency axis, multiplying the ~~thus-obtained~~ the replicated information symbols by a spreading code along a frequency axis, thus spreading the information symbols into components of a plurality of sub-carriers having different frequencies, and thus rendering multiplex transmission of the information, comprising the step of

enabling a transmission rate of the information to be changed by controlling the amount of information transmitted simultaneously by controlling the number of the information symbols to be used in the spreading into the plurality of sub-carrier components for each user to which the information is to be transmitted.

Claim 2 (Currently Amended): The method as claimed in claim [[2]] 1, wherein codes which are orthogonal with each other are used as the spreading codes used in the spreading of the information symbols for respective users.

Claim 3 (Original): The method as claimed in claim 1, wherein the number of sub-carriers assigned for the spreading of all the information symbols to be transmitted simultaneously is fixed, and the number of sub-carriers assigned for the spreading of each information symbol is controlled.

Claim 4 (Original): The method as claimed in claim 3, wherein the number of information symbols to be used in the spreading into the plurality of sub-carrier components is in inverse proportion to the number of sub-carriers assigned for the spreading of each information symbol.

Claim 5 (Original): The method as claimed in claim 1, wherein the number of sub-carriers assigned for the spreading of each information symbol is fixed, and, according to the number of information symbols to be used in the spreading into the plurality of sub-carrier components, the number of sub-carriers assigned for the overall spreading of the number of information symbols is controlled.

Claim 6 (Currently Amended): The method as claimed in claim 1, wherein a group of sub-carriers assigned for the spreading of each of all the information symbols to be transmitted simultaneously is ~~made same~~ common among ~~[[the]]~~ respective information symbols, and the spreading codes used for the spreading of ~~[[the]]~~ respective information symbols are ~~made~~ different with respect to each other.

Claim 7 (Currently Amended): A multi-carrier CDMA radio transmitting method of replicating each information symbol, disposing ~~thus-obtained~~ the replicated information symbols along a frequency axis, multiplying the ~~thus-obtained~~ the replicated information symbols by a spreading code along the frequency axis, thus spreading the information symbols into components of a plurality of sub-carriers having different frequencies, and thus rendering multiplex transmission of the information, comprising the step of

enabling a transmission rate of the information to be changed by controlling multiplex transmission intervals along a time axis for each user to which the information is to be transmitted.

Claim 8 (Currently Amended): A multi-carrier CDMA radio transmitting method of replicating each information symbol, disposing ~~thus-obtained~~ the replicated information symbols along a frequency axis, multiplying the ~~thus-obtained~~ the replicated information symbols by a spreading code along the frequency axis, thus spreading the information symbols into components of a plurality of sub-carriers having different frequencies, and thus rendering multiplex transmission of the information, comprising the step of

enabling a transmission rate of the information to be changed by controlling the number of modulation levels used when the information symbols to be spread are obtained through data modulation.

Claim 9 (Currently Amended): The method as claimed in claim 1, wherein ~~the~~ respective sub-carriers assigned for the spreading of the information symbols are orthogonal along the frequency axis.

Claim 10 (Currently Amended): The method as claimed in claim 7, wherein ~~the~~ respective sub-carriers assigned for the spreading of the information symbols are orthogonal along the frequency axis.

Claim 11 (Currently Amended): The method as claimed in claim 8, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols are orthogonal along the frequency axis.

Claim 12 (Currently Amended): The method as claimed in claim 1, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols have frequency characteristics such that the frequency spectra do not overlap between each adjacent ~~sub-carriers~~ sub-carrier.

Claim 13 (Currently Amended): The method as claimed in claim 7, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols have frequency characteristics such that the frequency spectra do not overlap between each adjacent ~~sub-carriers~~ sub-carrier.

Claim 14 (Currently Amended): The method as claimed in claim 8, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols have frequency characteristics such that the frequency spectra do not overlap between each adjacent ~~sub-carriers~~ sub-carrier.

Claim 15 (Currently Amended): The method as claimed in claim 1, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed discretely along the frequency axis.

Claim 16 (Currently Amended): The method as claimed in claim 7, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed discretely along the frequency axis.

Claim 17 (Currently Amended): The method as claimed in claim 8, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed discretely along the frequency axis.

Claim 18 (Currently Amended): The method as claimed in claim 1, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed successively along the frequency axis.

Claim 19 (Currently Amended): The method as claimed in claim 7, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed successively along the frequency axis.

Claim 20 (Currently Amended): The method as claimed in claim 8, wherein [[the]] respective sub-carriers assigned for spreading each information symbol are disposed continuously along the frequency axis.

Claim 21 (Currently Amended): A multi-carrier CDMA radio transmitting apparatus replicating each information symbols, disposing ~~thus-obtained~~ the replicated information symbols along a frequency axis, multiplying the ~~thus-obtained~~ the replicated information symbols by a spreading code along the frequency axis, thus spreading the information

symbols into components of a plurality of sub-carriers having different frequencies, and thus rendering multiplex transmission of the information, comprising

a transmission-rate control part controlling the amount of information transmitted simultaneously by controlling the number of the information symbols to be used in the spreading into the plurality of sub-carrier components for each user to which the information is to be transmitted.

Claim 22 (Original): The apparatus as claimed in claim 21, wherein codes which are orthogonal with each other are used as the spreading codes used for the spreading of the information symbols for respective user.

Claim 23 (Original): The apparatus as claimed in claim 21, wherein said transmission-rate control part comprises a serial-to-parallel converting part converting series data which is the information to be transmitted to each user into parallel information symbols, and controls the number of the parallel information symbols obtained by said serial-to-parallel converting part.

Claim 24 (Original): The apparatus as claimed in claim 21, wherein the number of sub-carriers assigned for the overall spreading of the information symbols, the number of which is controlled by said transmission-rate control part, is fixed, and the number of sub-carriers assigned for the spreading of each information symbol is controlled.

Claim 25 (Original): The apparatus as claimed in claim 24, wherein the number of information symbols controlled by said transmission-rate control part is in inverse proportion to the number of sub-carriers assigned for the spreading of each information symbol.

Claim 26 (Original): The apparatus as claimed in claim 21, wherein the number of sub-carriers assigned for the spreading of each information symbol is fixed, and, according to the number of information symbols controlled by said transmission-rate control part, the number of sub-carriers assigned for the overall spreading of the number of information symbols is controlled.

Claim 27 (Currently Amended): The apparatus as claimed in claim 21, wherein a group of sub-carriers assigned for the spreading of each of all the information symbols, the number of which is controlled by said transmission-rate control part, is ~~made same~~ common among ~~[[the]]~~ respective information symbols, and the spreading codes used for ~~[[the]]~~ respective information symbols are ~~made different~~ with respect to each other.

Claim 28 (Currently Amended): A multi-carrier CDMA radio transmitting apparatus replicating each information symbols, disposing ~~thus-obtained~~ the replicated information symbols along a frequency axis, multiplying the ~~thus-obtained~~ the replicated information symbols by a spreading code along the frequency axis, thus spreading the information symbols into components of a plurality of sub-carriers having different frequencies, and thus rendering multiplex transmission of the information, comprising
an intermittent transmission control part controlling multiplex transmission intervals along a time axis for each user to which the information is to be transmitted.

Claim 29 (Currently Amended): A multi-carrier CDMA radio transmitting apparatus replicating each information symbols, disposing ~~thus-obtained~~ the replicated along a frequency axis, multiplying the ~~thus-obtained~~ the replicated information symbols by a spreading code along the frequency axis, thus spreading the information symbols into components of a plurality of sub-carriers having different frequencies, and thus rendering multiplex transmission of the information, comprising

a modulation level number control part controlling the number of modulation levels used when the information symbols to be spread are obtained through data modulation.

Claim 30 (Currently Amended): The apparatus as claimed in claim 21, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols are orthogonal along the frequency axis.

Claim 31 (Currently Amended): The apparatus as claimed in claim 28, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols are orthogonal along the frequency axis.

Claim 32 (Currently Amended): The apparatus as claimed in claim 29, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols are orthogonal along the frequency axis.

Claim 33 (Currently Amended): The apparatus as claimed in claim 21, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols have

frequency characteristics such that the frequency spectra do not overlap between each adjacent ~~sub-carriers~~ sub-carrier.

Claim 34 (Currently Amended): The apparatus as claimed in claim 28, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols have frequency characteristics such that the frequency spectra do not overlap between each adjacent ~~sub-carriers~~ sub-carrier.

Claim 35 (Currently Amended): The apparatus as claimed in claim 29, wherein [[the]] respective sub-carriers assigned for the spreading of the information symbols have frequency characteristics such that the frequency spectra do not overlap between each adjacent ~~sub-carriers~~ sub-carrier.

Claim 36 (Currently Amended): The apparatus as claimed in claim 21, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed discretely along the frequency axis.

Claim 37 (Currently Amended): The apparatus as claimed in claim 28, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed discretely along the frequency axis.

Claim 38 (Currently Amended): The apparatus as claimed in claim 29, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed discretely along the frequency axis.

Claim 39 (Currently Amended): The apparatus as claimed in claim 21, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed successively along the frequency axis.

Claim 40 (Currently Amended): The apparatus as claimed in claim 28, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed successively along the frequency axis.

Claim 41 (Currently Amended): The apparatus as claimed in claim 29, wherein [[the]] respective sub-carriers assigned for the spreading of each information symbol are disposed successively along the frequency axis.

Claim 42 (Withdrawn): A channel estimation method used for a multi-carrier CDMA radio transmitting system rendering radio transmission using n sub-carriers, for rendering channel estimation for each sub-carrier, comprising the steps of:

a) separating a received signal having a frame configuration comprising the n sub-carrier components including m sub-carrier components into which pilot symbols are inserted, into the respective sub-carrier components, where $m \leq n$;

b) using the pilot symbols included in the sub-carrier components obtained through the separation, and rendering channel estimation so as to obtain individual channel estimation results for the sub-carriers; and

c) rendering the channel estimation for each target sub-carrier based on the thus-obtained individual channel estimation results for the respective p sub-carriers and

relationship between a channel state for the target sub-carrier and a channel state for each of the p sub-carriers, where $p \leq m$.

Claim 43 (Withdrawn): The method as claimed in claim 42, wherein the relationship between the channel state for the target sub-carrier and the channel state for each of the p sub-carriers is obtained adaptively based on the respective channel states.

Claim 44 (Withdrawn): The method as claimed in claim 42, wherein: weighting information is obtained based on the relationship between the channel state for the target sub-carrier and the channel state for each of the p sub-carriers; and the individual channel estimation results for the respective p sub-carriers are weighted by the weighting information and are then combined so as to obtain the channel estimation result for the target sub-carrier.

Claim 45 (Withdrawn): The method as claimed in claim 44, wherein the weighting information is obtained based on mutual correlation obtained based on the individual channel estimation result obtained for the target sub-carrier and the individual channel estimation result obtained for each of the p sub-carriers.

Claim 46 (Withdrawn): A channel estimation apparatus used for a multi-carrier CDMA radio transmitting system rendering radio transmission using n sub-carriers, for rendering channel estimation for each sub-carrier, comprising:

a sub-carrier separating part separating a received signal having a frame configuration comprising the n sub-carrier components including m sub-carrier components into which pilot symbols are inserted, into the respective sub-carrier components, where $m \leq n$;

an individual channel estimation part using the pilot symbols included in the sub-carrier components obtained by the sub-carrier separating part, and rendering channel estimation so as to obtain individual channel estimation results for the sub-carriers; and

a channel estimation part rendering the channel estimation for the target sub-carrier based on the thus-obtained individual channel estimation results for the respective p sub-carriers and relationship between a channel state for the target sub-carrier and a channel state for each of the p sub-carriers, where $p \leq m$.

Claim 47 (Withdrawn): The apparatus as claimed in claim 46, wherein said channel estimation part comprises a part adaptively obtaining the relationship between the channel state for the target sub-carrier and the channel state for each of the p sub-carriers based on the respective channel states.

Claim 48 (Withdrawn): The apparatus as claimed in claim 46, wherein said channel estimation part comprises:

a weighting information estimation part obtaining weighting information based on the relationship between the channel state for the target sub-carrier and the channel state for each of the p sub-carriers; and

a weighting channel estimation part obtaining the channel estimation result for the target sub-carrier by weighting the individual channel estimation results for the respective p sub-carriers by the weighting information and then combining them.

Claim 49 (Withdrawn): The apparatus as claimed in claim 48, wherein:

said weighting information estimation part comprises a correlation measuring part obtaining a mutual correlation value based on the individual channel estimation result obtained for the target sub-carrier and the individual channel estimation result obtained for each of the p sub-carriers; and

obtains the weighting information based on the mutual correlation value obtained by said correlation measuring part.